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PSYCHE

Vol. 60 June, 1953 No. 2

TABANIDAE FROM THE STATE OF CHIAPAS, MEXICO, WITH DESCRIPTIONS OF TWO NEW SPECIES (DIPTERA)

By G. B. Fairchild

Gorgas Memorial Laboratory, Panama

A survey for Yellow Fever immunity in wild animals, primarily monkeys, undertaken by members of the staff of the Gorgas Memorial Laboratory at the request of the Pan-American Sanitary Bureau furnished an opportunity for the writer to visit several localities in the State of Chiapas, Mexico. Since records of Tabanidae from Chiapas are relatively few, it is believed that a report on the collections made may be of interest. Although all groups of biting insects were collected, only the Tabanidae will be discussed in detail here.

While we were in Chiapas about 5 weeks, from March 20 to April 25, 1951, only 20 days were actually spent in the field, collections being made in the following localities.

Tuxtla Gutierrez. This town, the capital of the state, was our headquarters in Chiapas. It lies in a broad valley in a rather dry limestone area. At the time of our visit little rain had fallen for some time, and except along the few streams, the scrubby vegetation was mostly leafless and insects little in evidence. Collecting along the banks of the Rio Sabinal, a small highly polluted stream on the outskirts of the town, yielded a few *Phlebotomus* and great numbers of *Culex* from hollows in large mango and cypress trees. *Simulium* were annoying at times around the hotel, especially during the latter part of our stay, and a few tabanids were taken on the windows of the hotel.

OCOSOCOAUTLA. This is a small town about 50 km. west of Tuxtla on the Pan American highway. Collecting was done on a forested ridge east of the town. The forest consisted mainly of evergreen oaks with fair numbers of *Bursera,* but no palms, much resembling a South Florida oak hammock. Epiphytes were very abundant. A good number of *Phlebotomus* were taken here from shallow buttresses and hollow trees, and a species of *Tabanus* was fairly abundant. Larval ticks fairly swarmed, as cattle had access to the forest. Only one visit of a few hours was made to this locality, on April 8.

PALENQUE. This town is situated in the north eastern corner of the state, not far from the border of Tabasco. The town itself is small and primitive, surrounded by nearly flat sandy country, partly forested and partly open grassland. We took several species of tabanids and *Phlebotomus* in swampy cut-over forest on the outskirts of the town on March 28. From that date to April 4 we were encamped in the Maya ruins which lie about 9 km. from the town on the slopes of a range of low limestone hills. Here we were surrounded by practically virgin forest of Humid Lower Tropical Zone type with abundant palms. Wild animals were quite abundant and monkeys of two genera, *Ateles* and *Allouata* were easily secured. Tabanids were very abundant, and good numbers of *Phlebotomus* and mosquitoes were taken.

SANTA MARIA. This is a hacienda about 51 km. north or north east of Cintalapa by road, about 35 km. airline, situated on the Rio Sta. Maria, a tributary of the Rio Grijalva. At the time of our visit there was a sawmill operating here, owned by the Coabas de Chiapas, S.A. where we made headquarters from April 10 to 19. The sawmill itself is said to be at an elevation of 800 metres and is in a narrow valley at the confluence of two small streams. Immediately adjacent to the sawmill the vegetation is of Arid Lower Tropical Zone type. Across the Rio Sta. Maria, the land rises steeply to a high ridge, the slopes clothed with heavy forest of Humid Lower Tropical Zone type with much mahogany and cedro, which was being cut for the sawmill. We made camp in this forest at a place called La Puerta, an abandoned lumber camp about 10 km. from the sawmill and said to be at the same elevation, though probably somewhat higher. Here the forest, although considerably cut-over, consisted of very large trees with many palms. It was distinctly dryer than Palenque, though some rain fell during our stay. We were at this camp from April 10 to 13. Collecting at both the camp and the sawmill was excellent.

Much of the collecting was done with the aid of a modified Shannon trap, although the use of a horse as described by Shannon (1939, Amer. J. Trop. Med. 19 (2) : 132-133) was dispensed with. During the day large numbers of Tabanidae and some mosquitoes entered the trap, while at night a gasoline lantern placed in the center compartment attracted nocturnal mosquitoes and some *Phlebotomus*. In the following list those species believed to be hitherto unrecorded for Mexico are starred.

**Assipala melanoptera* (Hine). 19 ♀ Sta. Maria, taken attempting to bite the collector at La Puerta camp. None were taken in the Shannon trap. Previously known only from Guatemala.

Chrysops latifasciata Bell. 3 ♀ Palenque, taken attempting to bite in the forest around the ruins. 3 ♀ Sta. Maria, attempting to bite around La Puerta camp.

Chrysops pachycnemia Hine. 1 ♀ Sta. Maria, in forest near sawmill.

Chrysops scalarata Bell. 1 ♀ Palenque, in swampy forest near village.

Chrysops variegata de Geer. 9 ♀ Palenque, in swampy forest near village and wet forest below ruins.

**Chrysops willistoni* Hine. 1 ♀ Palenque, in swampy forest near village. Previously known from Guatemala.

Scione aurulans Wied. 25 ♀ Palenque, very abundant at the ruins, biting man avidly and taken in Shannon trap during the day. 9 ♀ Sta. Maria, abundant at La Puerta camp, but less annoying than at Palenque. More specimens could easily have been taken at both localities.

Esenbeckia wiedemanni Bell. 10 ♀ Palenque, attacking man, attempting to bite dead monkeys, and in the Shannon trap at the ruins. 2 ♀ Sta. Maria, in trap at La Puerta camp.

Esenbeckia illota illota Will. 1 ♀ Palenque, attempting to bite man in the forest near ruins.

Diachlorus ferrugatus Fab. 4 ♀ Palenque, in Shannon trap at ruins.

Lepiselaga crassipes Fab. 1 ♀ Palenque, in Shannon trap at ruins.

Stenotabanus minusculus Kröb. 2 ♀ Palenque, in Shannon trap at ruins. The tibiae are wholly dark, as described, not lighter as in Panama material, but I can see no other difference.

**Stenotabanus* n. sp. 9 ♂ 21 ♀ Sta. Maria, attempting to bite and in trap at La Puerta camp. 9 ♀ also taken, mostly in Shannon trap at sawmill. Described below.

Dichelacera pulchra Will. 9 ♀ Palenque, in Shannon trap at ruins and attempting to bite in the forest. 1 ♀ Sta. Maria, in trap at La Puerta camp. Smaller and less contrastingly marked than Guatemalan specimens.

Chlorotabanus mexicanus Linn. 1 ♂ Palenque, attracted to light near camp in ruins.

Leucotabanus leucaspis Wied. 1 ♀ Sta. Maria, in trap at sawmill.

**Leucotabanus canithorax* Fchld. 1 ♀ Palenque, in trap at ruins.

Tabanus (*Tabanus*) *subruber* Bell. 2 ♂ 42 ♀ Palenque, very abundant both at village and at ruins, attacking horses in swarms and humans to a lesser extent, entering Shannon trap in very large numbers, where hundreds could have been collected. 7 ♀ Sta. Maria, present in fair numbers both at camp and sawmill, but only a few collected.

Tabanus (*Tabanus*) *yucatanus* Towns. 6 ♂ 2 ♀ Ocosocoautla, males hovering a few feet above trails, females flying around collector and seen biting cattle. 3 ♂ 22 ♀ Sta. Maria, males hovering over small stream, females in trap. 1 ♂ 1 ♀ Tuxtla Gutierrez, on hotel windows.

Tabanus (*Lophotabanus*) *oculus* Walk. 1 ♀ Palenque, in Shannon trap near ruins.

**Tabanus* (*Lophotabanus*) *piraticus* Fchld. 5 ♀ Palenque, in forest near ruins in trap and attempting to bite. 12 ♀ Sta. Maria, in trap and attempting to bite in forest around La Puerta camp. This species somewhat crepuscular.

Tabanus (*Taeniotabanus*) *lineola* var. *carneus* Bell. 1 ♀ Tuxtla Gutierrez, on hotel window.

Tabanus (*Taeniotabanus*) *amplifrons* Kröb. 1 ♀ Tuxtla, on hotel window.

Stenotabanus (Stenotabanus) chiapasensis n. sp.

Fig. 1

Female. Length 7.5-10 mm., of wing 7-8.5 mm. Eyes bare, in life purple to reddish brown with three narrow transverse bands of green or bluish green. The extreme upper margin is greenish purple or narrowly greenish blue. Frons moderately broad, about 3 times as high as wide, light yellowish grey pollinose. Basal callus black, nearly square, as wide as frons, rather protuberant and with two pits or dimples on the upper margin. No median callus in undenuded specimens, though rubbed examples may show a denuded streak on each side and indications of a fine median ridge. Vertex with a rounded flat shiny area, but without swelling, tubercle or vestiges of ocelli. Subcallus, fronto-clypeus and genae yellowish grey, paler than frons, the last two with long pale hairs. Antennae orange yellow, the annulate portion of third segment black. Basal plate longer than annulate portion, moderately wide, evenly rounded above. Palpi yellowish, white pollinose, beset with white hairs basally, black hairs apically, rather slender Proboscis short, hardly exceeding palpi, the labella large and membranous.

Mesonotum and scutellum dark blackish brown with three yellowish pollinose stripes and the lateral margins of mesonotum and apex and margins of scutellum also yellowish pollinose, both mesonotum and scutellum beset with sparse shiny yellowish and black hairs. Pleura and sternum steel grey pollinose, thinly white haired. Wings with subepaulet bare, costa, subcosta and first vein setose above, subcosta more densely setose below; a rather long appendix on upper branch of third vein. Wings hyaline, all cross veins and fork of third vein with faint to quite intense dark clouds; apices of 2nd (R_2) and upper branch of 3rd (R_{3+4}) veins with dark clouds and apices of cells R_1, R_2 and R_4 somewhat dusky. Stigma yellow. Fore coxae yellowish, grey pollinose, pale haired. Fore femora brown, dusky at apex, mostly dark haired. Fore tibiae yellowish and yellow haired on basal half, blackish and black haired apically, as are the tarsi. Mid legs yellowish brown, the tips of tibiae and tarsi a little darker, mostly pale haired. Hind femora brown, grey pollinose, pale haired. Hind tibiae and tarsi yellowish, black haired dorsally, yellow haired beneath.

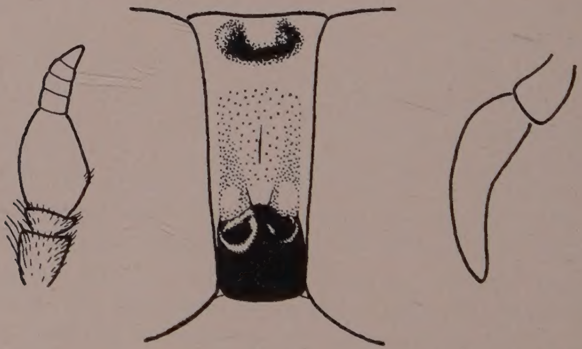

Fig. 1. *Stenotabanus chiapasensis* n. sp. Holotype. Antenna, frons and palpus x 22.

Abdomen light brown with the following pattern in yellowish and dark brown pollinosity. First tergite mainly dark brown, the anterior angles somewhat bluish, the posterior margin narrowly yellowish. Second to sixth tergites dark brown with a narrow yellowish posterior and lateral borders, broad median longitudinal yellowish bands which reach both margins but are narrower anteriorly and small round isolated yellowish dorsolateral spots, one on each side. Seventh tergite brown with yellow posterior border. The brown areas and the dorsolateral spots are clothed with black hairs, the remaining yellow areas with yellowish hairs. Beneath the abdomen is thinly grey pollinose, wholly pale haired.

Male. 8-9 mm., of wing 7-8 mm. Head enlarged, eyes bare, holoptic, the area of large facets somewhat over 1/2 total eye area, the two types of facets well differentiated and demarkated. Large facets brown, small facets purple with two narrow green bands and a small segment of a third band at extreme outer angle. Tubercle at vertex deeply sunk between eyes, hardly discernible. Frontal triangle yellowish grey pollinose. Antennae more slender than in female, yellow, the annulate portion black. Palpi inflated, porrect, cylindrical but ending in a sharp point, clothed with long black and white hairs. Wings, legs, thorax and abdomen as in female, except that the abdominal color pattern is less sharply marked, the pollinosity sparser and all hairs longer. The abdomen is also very much more slender, the last few segments narrowed almost to a point.

Holotype, female, Hacienda Sta. Maria, on Rio Sta. Maria, 35 km. north of Cintalapa, Chiapas, Mexico, 15 April 1951.

Allotype male, same locality, 11 April 1951.

Paratypes 28 females, 7 males, same locality, 11, 15 and 18 April 1951, attempting to bite the collectors or in a Shannon trap. All Fairchild and Hartmann colls.

This little species appears to most nearly resemble *St. cribellum* O. S., sharing with it the presence of a bare patch at vertex, but no true tubercle and having a similar frons and callus. In rubbed specimens the trident-shaped median callus shown by Stone (1938) for *cribellum* is quite evident. The male, however, has but a vestige of a vertical tubercle, deeply sunk between the eyes and difficult to detect and the facets are very well differentiated, somewhat in contrast to the male of *cribellum* described by Philip (1941, p. 11). The abdominal pattern and spotted wings will easily separate the present species from *cribellum, pumiloides* Will., *campechianus* Towns. and *subtilis* Bell, all of which appear to be small species with relatively broad frons and a more or less distinct median stripe on abdomen.

This species appears to me to form in some ways a connecting link between such species as *St. littoreus* Hine, and *paitillensis* Fchld. which I would place in *Aegialomyia* Philip, and the more typical species of *Stenotabanus* as represented by the Genotype *taeniotes* Wied. and the closely related *fulvistriatus* Hine. The latter have definite vestiges of ocelli on a small vertical tubercle, and the vertical tubercle of the male of at least *fulvistriatus* is quite obvious and on a level with the eyes. The eye pattern of *chiapasensis* is also closely similar to that of *fulvistriatus*. On the other hand, the relatively broader frons, lack of vertical tubercle and abdominal pattern, seem to indicate relationship to *littoreus*. The pattern of the eye in life seems to be of little help in grouping these species, as *fulvistriatus* has a pattern very much like *jamaicensis* Newst., *ananasi* Fchld. and *psamophilus* O.S., while the eyes of *littoreus* Hine have but two green bands. *Paitillensis* Fchld. is intermediate, having three green stripes, but the middle one very narrow.

I take this opportunity to describe the following new species here, since part of the material is from Chiapas, though it was not taken on our trip.

Stenotabanus (Stenotabanus) litotes n. sp.

Fig. 2

Female. Length 9-11.5 mm., of wing 9-12 mm. Eyes bare, purple with two transverse green bands separated by a purple median band of equal width. Frons yellowish grey pollinose, the basal callus dark brown to black, a little higher than wide, not quite as wide as frons, prolonged above in a spindle-shaped ridge or median callus. Vertical tubercle small but discrete, with vestiges of ocelli and surrounded by a discolored patch which may be more or less bare. Subcallus yellowish pollinose, concolorous with frons, fading to steel grey on genae and frontoclypeus. Beard pale grey. Antennae dull yellowish throughout, the first two segments sparsely pale pollinose and black haired, the third rather slender with a weak to moderate dorsal angle. Palpi moderately inflated, slender tipped, yellowish, white pollinose, mostly black haired but with more or less white hair basally. Proboscis short, hardly exceeding palpi, brown, the labella fleshy.

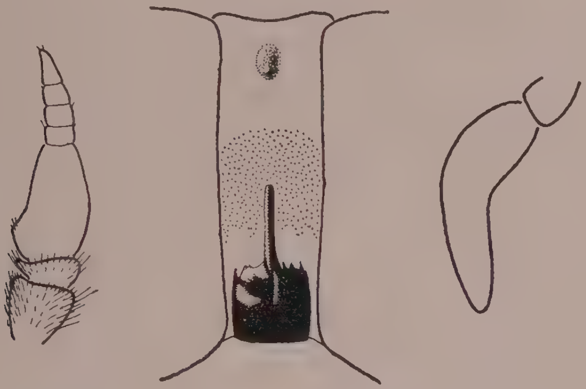

Fig. 2. *Stenotabanus litotes* n. sp. Holotype. Antenna, frons and palpus x 22.

Mesonotum light brown, thinly greyish brown pollinose and with two slender, rather faint, yellowish pollinose stripes. Both mesonotum and the concolorous scutellum clothed with pale hairs. Pleura and sternum pale grey, sparsely pale haired. Wings with subepaulet bare, costa, subcosta and first vein setose above, and a short to moderate appendix on upper branch of third vein. Wings faintly yellowish smoky, but without distinct clouds or streaks; costal cell not darker, stigma yellow. Legs dull yellowish brown, the tarsi darker and fore tibiae obscurely bicolored through having pale hairs on basal half, black hairs distally.

Abdomen brown, mainly brown pollinose, but the hind and lateral margins of all tergites pale yellowish pollinose. There are also indistinct pale pollinose narrow median triangles, in most specimens forming a faint to clear median stripe, in a few interrupted on the anterior part of each tergite. In most specimens there are no indications of dorsolateral spots, but in a few there are obscure and ill-defined paler dorsolateral patches on some or all tergites. Pale yellowish hairs clothe the pale pollinose areas, dark hairs the dark areas. Beneath the abdomen is pale grey, wholly pale haired.

Holotype female, labelled "M.F. 4222 Vigi. Chis. 20-V-35" probably Finca Vergel, Chiapas, Mexico.

Paratypes, 2 females same locality as holotype, labelled 15-V-35 and 21-V-35; 4 females Panajachel, Guatemala, 6 Aug. 1943, and 1 female Tzanjuyu, Panajachel, Guatemala, 20 Aug. 1943, D. M. Jobbins coll.; 3 females Antigua, Guatemala, no date, J. R. de Leon coll.; 4 females Yepocapa, Dept. Chimaltenango, Guatemala, 11 Aug. (1) and 31 Oct. (3), 1949, H. T. Dalmat coll.

The holotype and the two other Chiapas specimens are from the late Dr. A. Dampf's collection, labelled in his handwriting, and sent to me by Dr. C. B. Philip. The holotype and seven paratypes are in Dr. Philip's collection, the remaining paratypes in the author's collection.

This obscurely marked little species was tentatively determined by both Dr. Philip and myself as *St. pallipes* Kröber, described from Brazil. Kröber's description was drawn from a specimen preserved in alcohol, but indicates a much paler, more yellowish insect, and the wings are described as absolutely glass clear. Three of the present series were also alcoholics, but are very much darker than Kröber's description indicates. The present species also shows differences in the frons and a somewhat broader third antennal segment and more slender palpi.

From the description of *Tabanus subtilis* Bell the present species differs in having wholly pale antennae and pale femora. Dr. Bequaert's notes on the types show that *subtilis* is a *Stenotabanus*, with bare subepaulets, and he confirms the presence of a black annulate portion to the third antennal segment.

Tabanus pumiloides Will. differs, according to the description, in having a much more marked angle on the dorsal aspect of the third antennal segment, and also in having a black annulate portion to this segment. The legs are said to be black with the tibiae basally yellow. It seems difficult to separate *pumiloides* and *subtilis* from the descriptions. Both were described from Mexico, *pumiloides* from Guerrero and Jalisco, *subtilis* from Oaxaca. Direct type comparisons will be needed to achieve certainty in this difficult group, but the present species is separable on color characters at least.

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STONE, A.

1938. Horseflies of the subfamily Tabaninae of the Nearctic region. U.S.D.A. Misc. Pub. 305: 1-171, 79 figs.

PHILIP, C. B.

1941. Comments on the supra-specific categories of Nearctic Tabanidae. Can. Ent., 73: 1-14.

AN AUSTRALIAN TRAPEZIOPELTA (HYMENOPTERA: FORMICIDAE). — Specimens of *Trapeziopelta* collected by me at Mt. Dandenong (2000 feet) and Olinda (1600 feet) under stones in grassy-floored moist sclerophyll (eucalypt) forest, Dandenong Ranges, Victoria, Australia compare very closely with the types of *Myopias tasmaniensis* Wheeler (1923, Psyche, 30: 177-179, fig. 1, worker), kept in the Museum of Comparative Zoology at Harvard University. My series also compared equally well with types of *Trapeziopelta diadela* Clark (1934, Mem. Nat. Mus., Melbourne; No. 8: 54-55, pl. 4, figs. 7, 8, worker and female). All of the specimens concerned belong to one species, which is correctly assigned to *Trapeziopelta* on the basis of the clypeal structure. The correct name of the species is therefore *Trapeziopelta tasmaniensis* (Wheeler), **new combination,** and *T. diadela* Clark is its **new synonym.** The species is now known from widely separated localities in Tasmania and southern Victoria, where it appears to prefer higher-rainfall sclerophyllous forest.

At least two other species of *Trapeziopelta,* remaining unstudied, occur in southeastern and northeastern Queensland. — W. L. BROWN, JR., Museum of Comparative Zoology, Harvard University.

AUSTRALIAN CARABID BEETLES I.
SOME *CLIVINA* FROM WESTERN AUSTRALIA[1]

By P. J. Darlington Jr.
Museum of Comparative Zoology, Harvard University

This is the first of what I hope will be a long series of papers on Australian Carabidae. The papers will be based chiefly on the collection of the Museum of Comparative Zoology. The Museum possesses much material secured in Australia, especially in eastern and southwestern districts, by myself and other members of the Harvard Australian Expedition of 1931-1932; some collected by myself in South Queensland in October and November 1943, while I was staging with the 26th Malaria Survey Unit of the Army of the United States; and sets of duplicates from the South Australian Museum, the National Museum at Melbourne, and from several private collectors; and recently we have received additional interesting specimens from many localities in Australia collected in 1950-1951 by Dr. W. L. Brown, now Assistant Curator of Insects at the M. C. Z. I plan to work up appropriate portions of this material in connection with study of large collections of New Guinean Carabidae secured during the war. The present paper concerns certain interesting Western Australian species of the nearly cosmopolitan genus *Clivina*.

My intention in this series of papers is, so far as possible, to describe only those new species which are well defined and of which we have more than one specimen, and to return at least one of the type series of each new form to Australia. I am particularly anxious that a good set of specimens be deposited at Canberra, with the collection of the late Thomas G. Sloane, who did so much fine work on Australian Carabidae.

The papers of this series are to be regarded as preliminary to more extensive work which I plan to do on Australian Carabidae after (I hope) another collecting trip to Australia and accumulation of much more material. The later work is planned to take the form of revisions with comparative illustrations. Since I cannot foresee the exact forms of illustration which will prove most useful in different groups, I do not plan to illustrate the present preliminary series.

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[1] Published with a grant from the Museum of Comparative Zoology at Harvard College.

All statements of proportions, *e. g.* the relative widths of head and prothorax, in my descriptions are based upon actual measurements made with a ruled ocular in a binocular microscope. It is not possible to estimate proportions accurately without measuring. Width of head includes the eyes; width of prothorax is greatest width; length of prothorax, length at middle including margins, but not including advanced anterior angles or the peduncle; width of elytra is greatest width; length of elytra, length from a transverse line tangent to the base to apex at suture, with the specimen in normal, flat position.

Sloane's revision of Australian *Clivina* appeared in 1896; his supplementary revision of certain groups, in 1904; and additional descriptions in 1896, 1907, 1916, 1917, and 1923 (see references). These papers lay the groundwork for classification of the Australian species of the genus, but much detailed work remains to be done. There is hardly a species which does not need to be redescribed and figured and its variations studied. Two characters deserve special mention here, one because it has been overstressed by Sloane, the other because it has not been noticed enough. The transverse impression of the declivity of the prosternal process is not a trustworthy taxonomic character; the impression is sometimes both present and absent in different specimens of series of single species from single localities. The inner or flying wings, supposed by Sloane (1896, p. 145) always to be present in Australian *Clivina*, are actually vestigial in some of the species, including one of the new ones described below. Dimorphism of inner wings may occur too, but has not yet been demonstrated in any Australian species of *Clivina*.

The new species of *Clivina* here described have been checked not only against the collection of the Museum of

Comparative Zoology and the literature, but against the collection of the British Museum, which contains Blackburn's types and specimens identified by Sloane. The present new species all go into *Clivina* in the strict sense in Kult's classification (*Acta Soc. Ent. Čechosl.* [Czecholovakia] XLIV, 1947, 26-37).

Clivina frenchi Sloane (1896, p. 159)

Previously known from North Queensland and from Lake Callabonna, South Australia. I took a series of specimens, which agree exactly with the description, near WILUNA, interior of WESTERN AUSTRALIA, September 28 to October 3, 1931, some on the shores of Lake Violet (near Lake Way) and others beside water holes on Mr. Alfred G. Paterson's station, "Yandil". These specimens vary in size from about 7.0 to 9.5 mm., and in color from dark piceous to rufous with head and prothorax slightly darker. The elytral striae are all free at base in most specimens, but the basal end of the 5th stria is very close to that of the 6th and occasionally the two are connected, leaving only 4 striae free at base. This is an example of the sort of variation, affecting Sloane's group characters, which has not yet been properly studied in most Australian *Clivina*, and which must be understood before the species can be finally arranged in natural groups. *C. frenchi* is apparently closely allied to *C. obsoleta* Sloane (and to the following new species), although Sloane put *frenchi* and *obsoleta* in different groups.

Clivina diluta n. sp.

Parallel, cylindrical, but not more slender than usual; head very large, neck wide; shining, head and prothorax piceous or castaneous, elytra more or less dilute brown; body below piceous or dark rufous, somewhat paler *anteriorly;* anterior legs rufous, antennae and middle and posterior legs brownish testaceous. *Head* 7/8 or slightly less wide as prothorax (by measurement—to the eye, the head seems virtually as wide as prothorax); mandibles rather short; clypeus with middle part separated from wings, depressed, and rather strongly emarginate at middle, with angles of median part forming strong teeth; clypeal wings almost as prominent as teeth of median part, with outer angles narrowly rounded, separated from supra-antennal plates by distinct notches; eyes small, only slightly more prominent than supra-antennal plates, but not enclosed behind; 2 supra-orbital setae each side in all specimens; front not distinctly separated from clypeus, only slightly convex, with frontal sulci recurved; occiput without transverse impressed line; middle of front and usually sides and vertex also, but not occiput, closely punctate. *Prothorax* with lateral margins entire or nearly so, but in some specimens becoming vague or obsolete just before reaching basal margin; without longitudinal foveae on episterna; about as long as wide, with sides approximately parallel; front margin distinctly emarginate (as seen on a line perpendicular to pronotum); posterior angles broadly rounded; anterior angles acute except finely blunted (as usual); disc with median line fine, but distinct, anterior transverse impression more or less obsolete, sub-basal lateral impressions long, reaching to slightly in front of middle; surface of disc finely, sparsely punctulate and with a few irregular transverse strioles; posterior declivity vaguely rugose. *Elytra* parallel, hardly 1/20 wider than prothorax, truncate at base; 4 inner striae free at base, 5th united with 6th; subhumeral carina short, not very distinct; striae almost entire, but vague or obliterated just before apex, punctulate; intervals nearly flat, 3rd with usual 4 distinct setigerous punctures on outer edge, surface of intervals with some fine, irregular, transverse strioles, but not distinctly punctulate. Prosternal process very narrow (attenuate) between anterior parts of coxae; prosternal episterna and lower surface of head and abdomen, especially at sides, with distinct isodiametric microsculpture; body virtually impunctate below. Anterior femora rather strongly lobed below; anterior tibiae each strongly 4-dentate externally, and with upper internal spine somewhat curved and thickened; middle tibiae each with a spur about 1/3 from apex externally. Length about 6.3-7.0; width about 1.7 mm.

Holotype (M. C. Z. Type No. 23,091) and 7 paratypes all from Wiluna and vicinity, Western Australia, most from

Lake Violet but a few from "Yandil", Sept. 28-Oct. 3, 1931; from banks of ponds and water holes.

This new species is closely related probably only to *Clivina obsoleta* Sl. of Cape York (see Sloane's key, 1896, p. 162). The most important difference is probably in the form of the anterior angles of the prothorax. The prothorax is described as slightly narrowed anteriorly in *obsoleta*, with anterior margin truncate and anterior angles obtuse; while in *diluta* the prothorax is parallel, with anterior margin slighly emarginate and anterior angles somewhat acute except that, as usual in this genus, they are slightly blunted. Moreover, the head is probably much more closely punctate in *diluta* than in *obsoleta*, the front of the clypeus is emarginate at middle (described as truncate in *obsoleta*), and the description of *obsoleta* suggests other slight differences. I have not seen specimens of *obsoleta*. I believe that *diluta* is distinct from it, but the former may prove to be only a well-defined western subspecies of it rather than a separate species. The present new species, *diluta*, resembles *C. frenchi* Sl. (as *obsoleta* too is said to do) but is smaller, with a (short) subhumeral carina, relatively longer prothorax, and clypeus much more deeply emarginate at middle. These differences are not sexual, for dissection shows that I have both sexes of both species.

Clivina wiluna n. sp.

Parallel, cylindrical, head not unusually large; brown, darker (sometimes blackish) anteriorly. *Head* about 4/5 width prothorax; mandibles short; clypeus with middle part separated from wings, angles advanced and dentiform, clypeal wings angulate or sub-angulate externally, nearly as prominent as angles of median part, separated by distinct notches from supra-antennal plates; latter with outer angles somewhat variable in form but usually less (never more) prominent than angles of clypeal wings; eyes prominent, much more so than supra-antennal plates; front not distinctly separated from clypeus, more or less (variably) impressed at middle, frontal sulci recurved, front sparsely or not distinctly punctate, except punctation sometimes more distinct at middle. *Prothorax* slightly (1/20 or 1/10) longer than wide, slightly but distinctly narrowed anteriorly; anterior margin approximately truncate; posterior angles broadly rounded, anterior ones right or slightly obtuse, blunted; disc with middle line distinct, anterior transverse impression obsolete or nearly so, sub-basal lateral impression short and vague; surface of disc smooth except for a few transverse strioles. *Elytra* only 1/10 or 1/20 wider than prothorax, parallel, truncate at base; 4 inner striae free at base, 5th united with 6th; sub-humeral carina short, indistinct; striae entire except some very briefly obsolete at extreme apex, punctulate; intervals slightly convex, 3rd with usual 4 distinct setigerous punctures on outer edge. Prosternal process very narrow (attenuate) between anterior parts of coxae; prosternal episterna dull; body impunctate below. Anterior femora stout, lobed below; anterior tibiae 4-dentate externally, the upper tooth much shorter than the others but distinct and acute; upper internal spine of front tibia somewhat curved and thickened; middle tibia with spur about 1/3 from apex externally. Length 5.7-6.4; width about 1.6 mm.

Holotype (M. C. Z. Type No. 23,092) and 14 paratypes from Wiluna and vicinity, Western Australia, most at "Yandil" but 1 from Lake Violet, Sept. 28-Oct. 3, 1931; from the banks of ponds and water holes.

Apparently closely related only to *Clivina cylindriformis* Sl. from the Gulf of Carpentaria (see Sloane's key, 1896, p. 162). The most important differences are that the front femur of *wiluna* is 4-dentate externally (described as 3-dentate in *cylindriformis*) and that in *wiluna* the clypeal wings are angulate and at least as prominent as and usually more prominent than the angles of the supra-antennal plates (clypeal wings described as rounded and apparently much less prominent than the angles of the supra-antennal plates in *cylindriformis*). As compared with the description of *cylindriformis, wiluna* evidently also has the median part of the clypeus with more prominent angles, the front much less punctate, and the color paler; and the prosternum is usually not sulcate across the base in *wiluna,* although this is not a trustworthy character. I have not seen specimens of *cylindriformis*. From *C. obsoleta* Sl., to which *wiluna* might be run in Sloane's key, *wiluna* differs in having a much smaller head, with relatively more prominent eyes.

Clivina suturalis Putz.

As Sloane has pointed out (1920, p. 122), *verticalis* Putz. and *dorsalis* Blackb. seem to be synonyms of this species. The species is extremely variable in color. A long series from Rottnest Island (near Perth), Western Australia, taken in October, 1931, varies from elytra testaceous with the sutural region only slightly reddish (these specimens possibly slightly immature) to black with only a short reddish dash behind the humerus, the dash not reaching the middle of the elytral length, and all stages of intermediates occur.

Clivina grata n. sp.

Of about average stoutness for *Clivina*, convex but not cylindrical; color either entirely rufous or rufous with elytra piceous black and lower surface posteriorly rufopiceous; surface above moderately shining. *Head* ¾ or a trifle less width prothorax; mandibles rather short but acute; clypeus with median part evenly slightly emarginate, separated from wings by indistinct, very obtuse notches; eyes small, enclosed behind by convex genae about as long as eyes and nearly as prominent; front not distinctly separated from clypeus, slightly convex between broad facial sulci; vertex slightly impressed at middle; vertex and front, but not clypeus, rather closely punctate. *Prothorax* 1/10 (slightly ±) longer than wide, widest about 1/3 from base, thence slightly narrowed anteriorly; posterior angles broadly rounded, finely denticulate, anterior angles minutely prominent; disc with median line and apical transverse line distinct, surface of disc entirely covered with fine, rather irregular punctation. *Elytra* 1/6 or 1/7 wider than prothorax, elongate oval rather than parallel, with humeri slightly narrowed; 3 inner striae free at base, 4th united with external striae; subhumeral carinae distinct; striae entire except partly obliterated at extreme apex, impressed and punctate on disc; discal striae convex, 3rd with 4 distinct setigerous punctures on outer edge. Prosternum transversely sulcate in front, prosternal process very fine (attenuate) opposite front margins of coxae; prosternal episterna closely rugulose; *indistinct* traces of punctation at sides of prosternum (not on episterna); hind body below roughened at sides but not distinctly punctate. Inner wings reduced to narrow strips about ½ length of elytra; metepisterna shortened. Anterior femur with lower, posterior margin approximately straight (faintly convex) as seen from behind; anterior tibia externally with three long teeth and (above them) a small triangular projection; middle tibia with a slender spur ⅓ or ¼ from apex. Length 5 mm. (or slightly less); width about 1.4 mm.

Holotype (M. C. Z. No. 23,093) and 2 paratypes all from near the town of Margaret River, southwestern division of Western Australia, October, 1931.

This species finds its closest relatives in the Heterogena Group of *Clivina.* In Sloane's second key (1904, p. 714) it would go with *olliffi* Sl. and *blackburni* Sl., differing from the former by being smaller and with narrower prothorax, and from the latter by having a distinct anterior transverse line on the pronotum. So far as I can judge from the descriptions alone, there are many other differences too. The separation of the median part of the clypeus from the clypeal wings in *grata* is so slight that the species might easily be referred to the Australasiae Group, where it would run (in Sloane's key, 1904, p. 719) to *ferruginea* or to *nigra* or *occulta,* but it probably is not really very closely related to any of these.

In my opinion, this new species (*grata*) really represents some stock close to *heterogena* Putz., modified as a result of reduction of the wings. The other characters which distinguish *grata,* especially the more oval elytra and shortened metepisterna, often accompany or follow wing-reduction among Carabidae (*cf.* Darlington 1936) and occur in some other (unrelated) flightless Australian *Clivina,* especially in the Procera Group. Even the reduced eyes of *grata* may be a secondary result of wing atrophy. I took, also at Margaret River, a single specimen of a *Clivina* which *may* represent the winged stock from which *grata* has been derived. It is bicolored like some examples of *grata* and is similar also in many ways structurally, but it is fully winged, with elytra parallel-sided, metepisterna long, and eyes relatively large. In these respects it is very close to *heterogena,* of which we have a series from Victoria. However, the Margaret River specimen differs from both *heterogena* and the present new species (*grata*) in having the abdomen rugose-punctate, most strongly so on the apical segment. The differences between this specimen and *grata* seem too great for them to be forms of a single dimorphic species. This specimen very likely represents a new species, but I do not care to describe it without more material.

Clivina sculpticeps n. sp.

Rather broad, subparallel, only moderately convex; rufous, not very shining. *Head* about 7/10 width prothorax; mandibles short; clypeus with marginal outline as in *australasiae* and its immediate allies, broadly emarginate at middle, with median part not at all separated from wings; latter rounded, separated from supra-ocular plates by obtuse notches; eyes prominent; front separated from clypeus by a deep and conspicuous transverse impression, and clypeus before impression with a broad more or less semicircular swelling; front and usually vertex somewhat variably longitudinally impressed at middle, and usually also with oblique irregular impressions at sides; frontal sulci long, recurved; front impunctate or virtually so; occiput with a few punctures at sides. *Prothorax* as wide as long or barely wider, moderately narrowed anteriorly; posterior angles broadly rounded, slightly dentate; anterior angles also rounded, but more narrowly so; disc with median and anterior transverse lines distinct, sub-basal lateral impressions faint or obsolete; surface of disc impunctate, with a few transverse strioles. *Elytra* about 1/10 wider than prothorax, only slightly narrowed anteriorly, with base subtruncate; humeri distinct, rather narrowly rounded; only 3 striae free at base; sub-humeral carinae well developed; striae entire, moderately impressed (less so apically), punctulate; intervals convex, 3rd 4-punctate as usual. Prosternum more or less sulcate transversely anteriorly, with episterna striolate and rugulose, not punctate;

prosternal process narrow but not "attenuate" between anterior parts of coxae; body below locally rugulose but not punctate. Anterior femora with lower posterior margin slightly convex; anterior tibiae strongly 3-dentate; middle tibia with a strong spur about ¼ from apex externally. Length 7.8-9.0; width 2.2-2.5 mm.

Holotype (M. C. Z. Type No. 23,094) and 4 paratypes all from Geraldton, Western Australia, October, 1931. Also 1 specimen, not a type, measuring only 6.5 by 1.8 mm., from Meekatharra, Western Australia (nearly 300 miles inland from Geraldton), Sept. 25, 1931.

The form of the clypeal margin and the distinct joining of the 4th and 5th elytral striae at base put this new species in Sloane's Australasiae Group. In Sloane's second key (1904, p. 719) it actually runs to *australasiae* and the latter's close relatives *lepida* Putz. and *dingo* Sl., but the new species (*sculpticeps*) differs from all of them by the conspicuous and rather complex sculpture of the head. The brown rather than black coloration is probably also a distinguishing character of *sculpticeps*, but a relatively unimportant one.

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SOME NEW DIPTERA WITH REMARKS ON THE AFFINITIES OF THE GENUS *PNYXIA* JOH.

By F. R. Shaw

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In a lot of material sent to me for identification by Dr. Peter Bellinger, while a student at Yale University, I found some specimens of unusual interest. Most of the insects fall in the genus *Bradysia** of the family Sciaridae. There were a few Mycetophilidae.

By far the most interesting insects were small Diptera resembling Cecidomyiidae. The females are wingless and lack halteres. The males have antennae similar to certain gall midges. At first, the specimens were believed to fall in the genus *Peyerimhoffia* but further study indicated that their affinities were not with this group. It was finally determined that the insects would fall within the genera *Pnyxia* Johannsen or *Epidapus* Haliday.

Through the kindness of Alan Stone of the U.S. National Museum, I was able to borrow specimens originally described by Hopkins as *Epidapus scabiei* but subsequently placed in the genus *Pnyxia* by Johannsen. Two characters used to recognize *Pnyxia* include the absence of the dorsal eye-bridge and the shape of the palpi. Since the dorsal eye-bridge is greatly reduced in the females I was examining, I wondered if Hopkins could have overlooked this structure. My material also possesses a one-segmented maxillary palpus as is characteristic of *Pnyxia*.

A thorough study of *Pnyxia scabiei* (Hopkins) revealed the complete absence of an eye-bridge. The palpi although one-segmented are more or less cup-shaped and possess a great number of small peg-like setae on the concave surface. These are entirely lacking in the specimens I was examining. Another feature I found of value to distinguish my material from *Pnyxia* is that in *Pnyxia* there is a snout-like projection above the antennae.

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* I am following the interpretation of Frey, 1948, of the generic concepts of the Sciaridae.

In general appearance, the males of my specimens closely resemble those of *Pnyxia* except for the palpal structure and presence of an eye-bridge. The eye-bridge in both sexes is greatly reduced being not over one facet wide in the male and possessing a total of eight facets in the female. In the female most of the facets are located in front of the ocelli and they are easily overlooked.

The systematic position of *Pnyxia* has been somewhat uncertain. Johannsen, 1912, indicated that according to Enderlein, this genus would be placed in the Mycetophilinae. Edwards, 1925, placed the genus in the Sciophilinae. Frey, 1942, makes the following statement concerning this genus, "nicht zu den Sciariden gehören die Gattungen *Pnyxia* Joh. und *Allostooma* Schmitz." My conclusions concerning this matter are that *Pnyxia* is a sciarid. The thoracic sclerites show that the affinities of the genus are closest to the Sciaridae. The reduced eye-bridge in the specimens I am naming as a new species of *Epidapus* is certainly a step toward the loss of the eye-bridge in *Pnyxia*.

A total of four new species was found in the course of study of the specimens. These include *Epidapus johannseni*, *Zelmira williami*, *Bradysia bellingeri* and *B. farri*. Their descriptions appear herewith.

Epidapus johannseni n. sp.

Male. Length 1 mm., General color dark brown, legs and abdomen lighter. Resembles a cecidomyiid in general appearance.

Head. Antennae about 1.5 the length of the body. The basal two segments compact, the second bulb-like. The flagellar segments, with the exception of the terminal one, attenuated at the tip, see figure 1. Antennal hairs more or less verticillate. The intermediate antennal segments are about 0.16 as broad as long. The attenuated portion of each of the segments is about 0.33 the length of the entire segment. Compound eyes sparsely hairy. Eye-bridge present, narrow, for the most part possessing a single row of facets.

Ocelli 3, prominent. Maxillary palpi one-segmented, somewhat paler than rest of mouthparts.

Thorax dark brown. Wing slightly more than 1 mm. long, slender, anal angle greatly reduced. Anterior wing veins most evident. Costa extends about 0.5 the distance from Rs to M_{1+2}. Humeral crossvein present. Only the radius with macrosetae. R_{1+2} ends at about 0.375 of length of wing. Rs ends before tip of M_3 at about 0.78 the length of the wing. Petiole of M indistinct. Petiole of Cu is practically absent. In some specimens the anterior branch of Cu appears to originate from the petiole of M. Halteres pale brown, about 0.25 the length of the wing. Legs dark brown. Tibial spurs present, paired on meso- and metathoracic legs. Anterior tibia about 0.81 the length of the tarsus. The basitarsus is about 0.40 the length of the tibia. Tarsal claws simple. Pulvilli and empodium with prominent hairs.

Abdomen. Brown in color, somewhat paler at tip. Clasper, figure 2, about 0.66 as broad as long has about 6 spines on the mesal, apical surface of which the dorsal one is most conspicuous. Frey's key, 1948, would place this species near *E. abieticola* Frey described from *N. Esbo.* It differs in the details of the structure of the hypopygium.

Described from 7 males from Mt. Higby Reservoir, Hartford County, Connecticut, March—July 1951.

Female. Length 1.5-2 mm. General color brown.

Head. Dark brown. Antennae 16-segmented, segments not attenuated at tip as in males. Antennal hairs somewhat verticillate. Antenna about 0.28 the length of the body. Compound eyes sparsely hairy. The number of facets is reduced. Dorsal bridge present but the number of facets not over 8 mainly located in area of bridge anterior to ocelli. Ocelli 3, prominent. Mouthparts small, maxillary palpi one-segmented with two prominent setae.

Thorax. Wings and halteres absent. Legs pale brown.

EXPLANATION OF PLATE 3

Fig. 1. Fifth flagellar segment of male *Epidapus johannseni*. Fig. 2. Dorsal view of male hypopygium of *Epidapus johannseni*. Fig. 3. Ventral view of male hypopygium of *Zelmira williami*. Fig. 4. Ventral view of male hypopygium of *Bradysia bellingeri*. Fig. 5. Ventral view of male hypopygium of *Bradysia farri*.

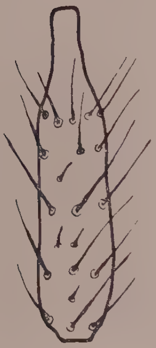

FIG. 1

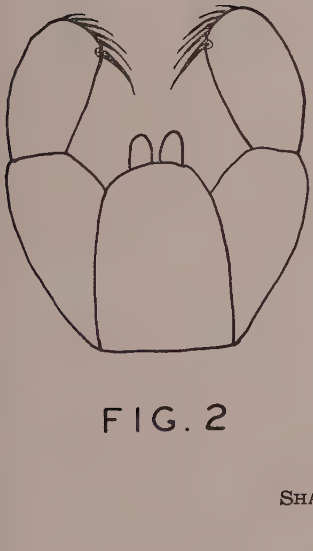

FIG. 2

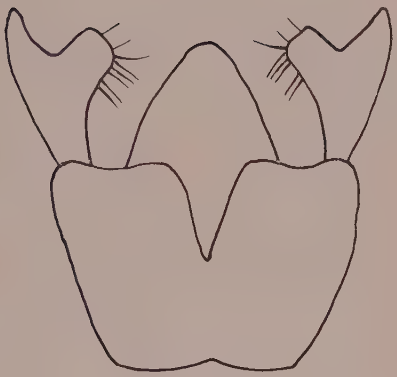

FIG. 3

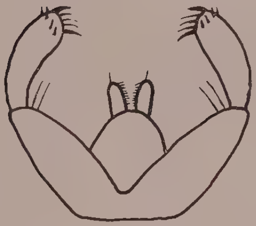

FIG. 4

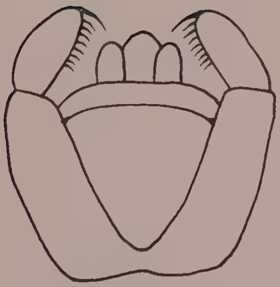

FIG. 5

SHAW — NEW DIPTERA

Coxae elongate, not especially robust as in *Pnyxia scabiei.* Tibial spurs present. Prothoracic tibia slightly shorter than tarsus. Basitarsus about 0.33 length of the tibia.

Abdomen pale brown. Ovipositor prominent.

Described from 35 specimens from Mt. Higby Reservoir, Hartford County; Middlefield; and Cathedral Pines, Litchfield County, Connecticut, January—August 1951. Male and female holotypes and 2 paratypes in my collection, the remainder in collection at Yale University.

I take pleasure in naming this species for Dr. O. A. Johannsen, an outstanding American dipterist.

Zelmira williami n. sp.

Male. Length 6 mm. General color brown.

Head. Dark brown. Antennae short, about subequal to length of the thorax. Ocelli 3. prominent. Maxillary palpi 3-segmented, first segment darker than the other segments.

Thorax. Dark brown. Postnotum with bristles. Pleurites are bare. Wings yellowish with a terminal dark band. Costa terminates at tip of R_{4+5}. Sc_1 ends before origin of Rs. Sc_2 present, about 1/2 way between humeral crossvein and tip of Sc_1. R_3 almost perpendicular to R_{4+5}, ends about 0.33 the distance from tip of R_{1+2} to tip of R_{4+5}. A brown band covers the terminal sixth of the wing. Fused portion of M subequal to the petiole of M. Two distinct anal veins. Legs yellow. The tarsi appear darker due to the presence of numerous black setulae. Prothoracic basitarsus about 0.9 the length of the tibia. Tibial spurs brown. Some of setae on meso- and metathoracic tibiae are arranged in lines. Halteres brown, the knobs a little darker.

Abdomen dark brown. Apices of segments 2-4 with yellow bands. Remainder of segments including the hypopygium dark brown. Clasper, figure 3, of the "genualis" type but lacks the long mesal spur. In Fisher's manuscript key this species would run to *Zelmira genualis* Joh. It can be distinguished from this species by the shape of the claspers and the shape of the tergum.

Described from 1 male collected in a soil sample from a virgin White Pine and Hemlock stand in Cathedral Pines, Litchfield County, Connecticut on May 16, 1951. Type in my collection.

I take pleasure in naming this insect for my son, William Morse Shaw.

Bradysia farri n. sp.

Male. Length 3 mm. General color dark brown.

Head dark brown. Antennae 16-segmented somewhat paler in color. Mouthparts yellowish brown. Maxillary palpi 3-segmented.

Thorax. Dark brown. Wings 2.75 mm. long. Costa strong, extends about 0.75 distance from tip of R_{4+5} to M_{1+2}. R_{1+2} ends at about 0.56 distance from wing base to its tip about opposite fork of M. Rs originates proximad of mid-point between humeral crossvein and tip of R_{1+2}. Both branches of radius have setae. M_3 ends only slightly beyond tip of R_{1+2}. Petiole of cubitus about 0.88 as long as basal portion of media Halteres pale brown. Legs—Coxae yellowish brown, remainder of legs yellowish. Ratio of prothoracic basitarsus to its tibia 0.60. Tibial spurs yellowish with dark setulae.

Abdomen dark brown. Hypopygium, figure 5, resembles somewhat that of *B. acuta* Joh. Clasper with a strong terminal spine and about 8 setae on its inner surface.

In Pettey's key, 1918, this species would run to *Bradysia varians* Joh. It differs from this species in venation, in the structure of the clasper, and in other details. Described from 1 male collected at Mt. Higby Reservoir, Hartford County, Connecticut on March 7, 1951. Type in my collection.

I take pleasure in naming this insect for Thomas Farr, an outstanding student in entomology who has a firm belief in the value of the study of insects in their natural habitats.

Bradysia bellingeri n. sp.

Male. Length 2.25 mm. General color dark brown.

Head dark brown. Antennae and mouthparts paler. Maxillary palpi 3-segmented, yellowish brown.

Thorax dark brown. Wing 2.0 mm. long. Costa extends about 0.75 the distance from tip of R_{4+5} to M_{1+2}. R_{1+2} ends proximad of fork M at about 0.5 the length of the wing. Rs originates about 0.70 the distance from the humeral crossvein to the tip of R_{1+2}. Only the radius has setae. M_3 ends opposite tip of R_{4+5}. Petiole of cubitus about 0.60 as long as basal portion of media. Halteres pale brown, tips darker. Legs yellow, appearing darker toward apices due to presence of fine black setulae. Prothoracic basitarsus about 0.62 as long as the tibia. Tibial spurs yellow.

Abdomen dark brown, terminal portion somewhat paler. Hypopygium, figure 4, resembles *Bradysia diluta* Joh. somewhat.

In Pettey's key, 1918, this species would run to *Bradysia scita* Joh. It can be distinguished from *B. scita* by the structure of the clasper of the hypopygium which lacks a mesal lobe as shown for *scita*. In addition *B. bellingeri* possesses a strong apical spine and 3 sub-apical spines on the mesal surface. Described from 1 male collected in a soil sample from a stand of Red Pine at Mt. Higby Reservoir, Hartford County, Connecticut on March 27, 1951. Type in my collection.

I take pleasure in naming this species for Dr. Peter Bellinger who sent me these specimens for determination.

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THE BIOLOGY OF *EUPHASIOPTERYX BREVICORNIS* (TOWNSEND) (DIPTERA, TACHINIDAE), PARASITIC IN THE CONE-HEADED GRASSHOPPERS (ORTHOPTERA, COPIPHORINAE)*

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The presence of oddly placed, supernumerary "spiracles" on a number of cone-headed grasshoppers [*Neoconocephalus r. robustus* (Scudder)] collected on Cape Cod in August, 1951, suggested parasitism by dipterous larvae, probably of some tachinid fly. Collection and confinement of a number of parasitized individuals during late summer in 1952 and '53 eventually led to the successful rearing of three male and two female flies. After considerable study, which involved not only these specimens but a large part of the accessible material in the difficult tribe Ormiini, C. W. Sabrosky of the Bureau of Entomology and Plant Quarantine is now describing the fly as a new subspecies of *Euphasiopteryx brevicornis*. (Sabrosky, in press). Reinhard in 1922 published a record of three larvae which emerged from an adult cricket, *Gryllus assimilis*, and formed puparia. Although no flies emerged, C. T. Greene identified the puparia as *Ormia* (now *Euphasiopteryx*) *ochracea* (Bigot). There is but one record of undoubted host relationship for the genus, that of "*E. australis* (Tns.)" as a parasite of the Brazilian mole cricket, *Scapteriscus vicinus* Scudder, reported by Wolcott (1940).[1] The cryptic habits of both host and parasite emphasized in the present paper further explain the scarcity and incompleteness of the previous life history data on these flies.

The locality where the parasitized cone-heads were collected is a narrow 16 acre tract, extending from the beachgrass-lined bay inland 0.4 mile to U.S. Route 6 in East Brewster, Mass. One fourth of the land bordering the beach is characterized by *Hudsonia*-lined sand-blows dotted with red pine, while the adjoining fourth is overgrown swamp. The remaining eight acres are largely open fields, supporting an occasional red cedar and bordered with clumps of bayberry and beach-plum. The cone-heads were confined to the beachgrass and open fields, although one or two specimens were taken in the bayberry bushes. Because of their alertness and habit of dropping from the tops of grasses and shrubs into inaccessible tangles below, the most practical collecting method is that of night-stalking. In early evening the ear-splitting, cicada-like song of a male is pin-pointed, then approached upwind; with careful maneuvering the singing insect may be spotted and grabbed or tricked into a ready net. Thus the taking of females is limited to chance sightings or association with singing males.

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[1] *Australis* sensu Wolcott=*E. depleta* (Wiedemann), teste Sabrosky, 1953; *E. australis* (Tns.) from Peru is distinct. Hereafter, *E. australis* sensu Wolcott will be used in quotation marks.

In this manner eight males were collected in the eight acre tract between 15 and 17 August, 1951; six were parasitized. On 3 August, 1952, seven males were parasitized of ten collected in the same area; three unparasitized males came from the beachgrass section. From the number of individual songs noted, probably at least 75 per cent of the male population in the tract were taken each season. The incidence of parasitism in this area, of the males at least, is certainly much higher than the one to five per cent

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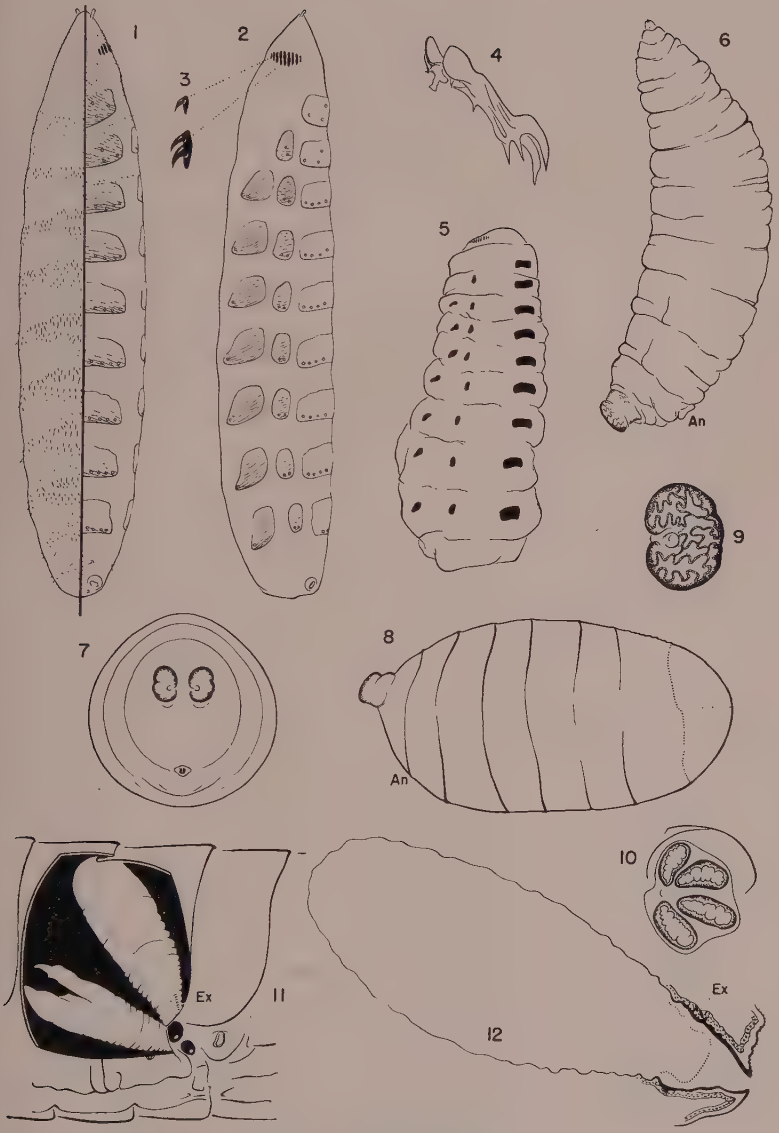
EXPLANATION OF PLATE 4

Euphasiopteryx brevicornis (Tns.). Fig. 1, left half, ventral aspect of 0.8 mm first instar larva; right half, dorsal aspect. Fig. 2, left lateral view of same, spines omitted. Fig. 3, detail of larval hooks. Fig. 4, first instar cephalopharyngeal skeleton. Fig. 5, 1.3 mm first instar larva after feeding. Fig. 6, nearly mature, 10 mm larva, An, anus. Fig. 7, posterior view of 8 mm puparium. Fig. 8, right lateral view of same. Fig. 9, detail of mature larval spiracular plate (x44). Fig. 10, detail of second instar spiracular plate (x457). Fig. 11, abdominal cutaway of the host, *Neoconocephalus r. robustus*, showing larval respiratory funnels in place; lower funnel was ruptured by escaping larva (x13). Fig. 12, longitudinal section of funnel showing larval posterior in place (dotted); Ex, first instar exuviae embedded in funnel wall (x40).



NUTTING — EUPHASIOPTERYX

reported by Wolcott (1951). A total of 50 larvae and vacated larval respiratory funnels was found in these 13 grasshoppers, an average of 3.85 per host. Two hosts contained one larva each, while two others contained eight and nine. Since all hosts were collected within three days in 1951 and on a single date in '52, the size range and probable age of the larvae are particularly noteworthy. In all specimens containing more than two larvae, considerable variation in larval size was found. This probably indicates different larval entry times, although it is also suggestive of feeding competition among the larvae. Two hosts which each contained one first instar larva, also contained six and seven other larvae of various sizes, including several three quarters grown. Another contained a first instar larva along with two more which were ready to pupate.

The dissection of three species of adult female ormiines by Townsend (1911) indicates that larviposition may be the rule with these flies. It is not known whether the females deposit their larvae directly on the host insects, or merely on ground or vegetation frequented by them. The armored, planidium type first instar larva (figs. 1 and 2), coupled with the following observations, suggests an active seeking out of host by larva. Four of the cone-heads collected contained first instar larvae, one of which was found in the muscles of the right hind femur, one quarter of the femur length from the coxa. This cone-head had been killed and pinned, so that even though the larva was found headed apically in the femur, there is no assurance that this was the case before death. Although it is tempting to speculate that it had entered the host through soft or membranous areas of the tarsus, it might be argued that it had entered at any other point and become diverted into the leg in making its way to the abdomen.

On the other hand, a careful autopsy of seven cone-heads showed that not one of 30 larvae was encountered in any part of the body but the abdominal cavity. Twenty more larvae, or larval funnels, in the six other cone-heads were also restricted to the abdomen. The second first instar larva was found near the anterior end of the mid gut, and the third in a tangle of malpighian tubules, both free in the haemocoele. The fourth larva (fig. 5) had recently become fixed to the pleural membrane on the left side of the fifth abdominal segment. This evidence suggests that the larvae are strongly attracted to the host's abdominal haemocoele, and that they probably do not often miss this goal. It is possible that entry may occasionally be effected via vulnerable areas of the appendages in contact with the ground. In any case, the paired sets of hooks on the second segment (fig. 3) undoubtedly assist the larvae during penetration of the host.

There was no apparent evidence of larval entrance on any of the 13 parasitized cone-heads, although it might be mentioned that five bore from one to four 0.5 to 1.5 mm scars on either or both faces of their hind femora. No such scars were found on the uninfected specimens. They may be significant, but it would be difficult to understand how or why the larvae would enter at such a point. It is more likely that these scars were earned during battle with other males, or perhaps during or after mating.

Although not exactly popular knowledge, the unusual respiratory funnels used by tachinid larvae for obtaining an atmospheric oxygen supply have long been known from the early biological researches of Nielsen (1909) and Pantel (1910). Baer (1920), Thompson (1928), and Beard (1942), have also contributed to our understanding of larval respiration and host relationships within this group of flies. (See Clausen (1940) for a comprehensive review.) York and Prescott (1952) have reported that similar funnels are also formed by nemestrinid larvae in grasshopper hosts. *Euphasiopteryx* behaves typically for, after the active larva enters the cone-head's abdomen, it perforates the host's body wall and settles down with its posterior spiracles in contact with the outside air until it is nearly ready to pupate. Perforation of the host integument may be accomplished by means of the minute circumstigmatal spines as suggested by Beard, or in the case of larvae such as these, perhaps by means of the postcephalic recurved hooks. In any event, the larva, with its spiracles in this hole, obstructs the normal healing of the wound in such a manner as to cause an inward growth of host integument which eventually forms a funnel around its posterior end (see Beard, 1942).

With *Euphasiopteryx*, the funnel walls are extended by a brownish, transparent, acellular membrane, so that the larva is completely enclosed in a sac-like structure (figs. 11 and 12). This type of funnel has been described for certain other tachinids, and Nielsen (1909) claims that the saccular portion is composed of the compacted walls of host fat body cells destroyed by the larva. Pantel (1910) presumed that the enclosed larva fed on the host's body fluids absorbed through the sac walls. However this may be, he stated that at a later stage such larvae pierce the sheath and feed actively on fat body and other tissues. This may be the case with *Euphasiopteryx*, for most over 6 or 8 mm long had ruptured their sheaths (fig. 11).

In the cone-heads examined, all the darkened external funnel openings were situated either in the soft pleural integument or in the ventral intersegmental membranes, from the first through the eighth abdominal segments (fig. 11). Internally the basal 1 or 2 mm of the funnel bear heavily sclerotized annular thickenings (fig. 12), while the whole structure is often enveloped in the lobular fat body, covered with blood cells and detritus, and wound round with malpighian tubules. The first instar exuviae (figs. 11 and 12, Ex) are embedded in the thickened layers of cuticle at the funnel base, but no trace of later molts has been found. Cast larval skins of the squash bug parasite, *Trichopoda pennipes* Fabr., have been found either embedded in the sheath or, more commonly, between the maggot and its sheath (Beard, 1942).

Although the remarkable first instar larvae of *Phasiopteryx montana* Tns. [*E. ochracea* (Bigot)] and *P. bilimeki* BB. [*E. bilimekii* (BB.)] were described and figured by Townsend (1912, 1942), drawings of this stage of *brevicornis* are included here for comparison. This active, armored larva (figs. 1 and 2), shortly after entering the host, measures about 0.8 x 0.15 mm. It has already done sufficient feeding so that the nine dorsal plates and the flanking rows of eight dorsolateral and seven ventrolateral plates no longer overlap as shown by Townsend. The light brown plates are sculptured, and bear a pattern of round, unpigmented spots. These hole-like dots form triangular patterns on the first two dorsal plates as described for *E. ochracea* by Townsend. In the present well preserved material, the spots do not appear to be origins of detached bristles as he suggested. Ventrally the abdomen is equipped with six compact groups of long spines instead of plates, while posteriorly and anteriorly the body is ringed with bands of microspines. The last segment, adorned with a few larger spines, bears the slightly raised spiracular plates which are bounded anterolaterally by a lightly pigmented area. Anteriorly there is a group of claw-like spurs on either side of the second segment, similar to those described for *E. bilimekii.* Each group is made up of nine heavily sclerotized rods, the seven median ones each bearing two hooks, and the end rods, one each (fig. 3). The cephalopharyngeal skeleton (fig. 4) extends back to the anterior margin of the first dorsal plate. The antennae are rather prominent elongate papillae. After considerable feeding, and at the time it becomes sedentary, this larva measures about 1.3 x 0.8 mm, and appears as shown in fig. 5.

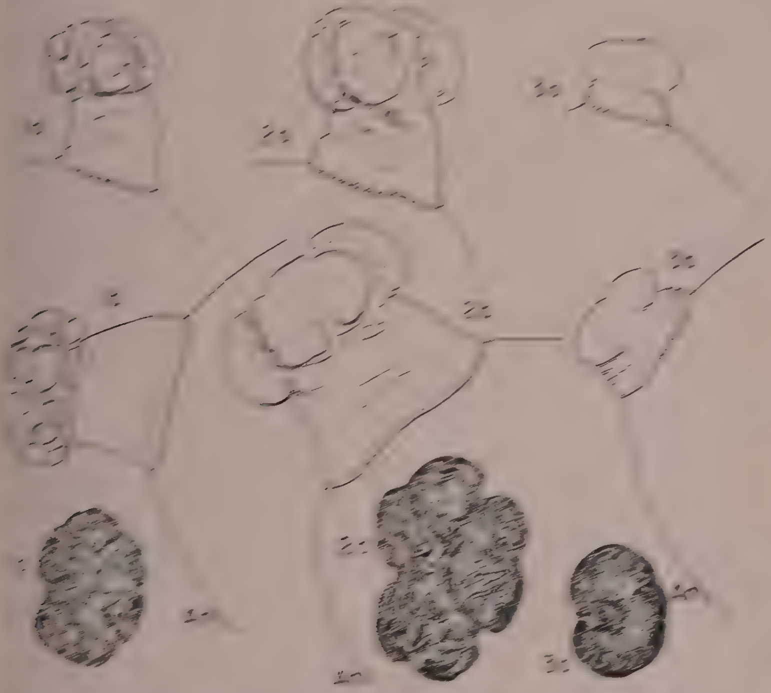
Mature larvae, ready to pupate (fig. 6), are typical white maggots and measure from 9 x 3 to 13 x 4.5 mm. They are practically smooth, although segmental bands of minute spines become barely visible at 90x in sectioned material. The pair of large, well separated posterior tubercles which bear the spiracles are shining black. The reniform spiracular plate (fig. 9) bears an inconstant serpentine pattern of minute parallel ridges. Between these ridges is a single row of breathing pores leading to the atrium within the tubercle. The stigmatic scar, representing the spiracle of the previous instar, is eccentrically placed opposite the hilum on the plate's inner margin. Figure 10 is a detail of the typically muscoid spiracular plate of the second instar larva. Prominent fleshy lobes mark the anal opening (An) which is rather remote from the spiracles.

From the 13 cone-heads collected and confined, 12 larvae escaped and successfully formed puparia. When ready to pupate the larvae pierced the host's integument, generally in the vicinity of their breathing funnels, although one may have emerged from the anus. They were given a choice of moist or dry, loosely packed earth with piles of dead grass for cover. The larvae were exceedingly active, humping frantically over the soil and exploring every part of the chamber. Some burrowed between or under loose, moist clods, but most of them settled under the grass on the moist surface. Within one to six hours all had become shortened and dark brown; puparia were formed a few hours later. One large specimen emerged from its host and formed a puparium within one hour.

As to the effects of the parasitism on the host, most of the cone-heads were active, singing and feeding nightly, until a day or two before the larvae emerged. A few hours before the exodus they became feeble and sluggish; two or three hours after even one or two larvae had emerged, the host was dead. Post-mortem examination showed a depletion of the fat body roughly proportionate to the number of parasites, but little apparent damage to the major organ systems. From these facts it is significant that larval survival is narrowly limited to those individuals within a particular host which reach maturity almost simultaneously. Two larvae emerged from one host within two hours of each other and pupated, while six other larvae, including one of the first instar, died inside the moribund host a few hours later. The total complement of three larvae escaped from another host and pupated successfully. This situation, involving larvae in staggered developmental stages within one host, is suggestive of a rather extended period of larviposition and a considerable endurance in the host-seeking first instar larvae. It might be added here that two heavily parasitized hosts also contained one and two specimens of a nematomorph, *Gordius* sp., coiled in their abdominal cavities. Further, three of the 1952 cone-heads each contained one nearly mature larva which Mr. Sabrosky has suggested as possibly *Beskia aelops*.

A female puparium is shown in figs. 7 and 8. Four male puparia vary from approximately 5.5 x 2.9 to 6.2 x 3.4 mm, and those of two females from 5.3 x 3.1 to 8.1 x 4.1 mm. The surface is finely wrinkled and the larval segmentation is fairly prominent. The line of dehiscence of the puparial cap, as well as a secondary fracture, is dotted in the figure.

Although [illegible] figured the pygidium of [illegible] (=[illegible]) [illegible] in 1922, spinular details of the three known pygidia of the genus are included in text fig. 1 for ready comparison. The [illegible] pygidium is dark mahogany with the spinular tubercles a shining black, while those of [illegible] and [illegible] are a dull brick red with subshining black tubercles. In all these species the tubercles are usually enlarged and well separated, [illegible] being the most extreme in these features. The tubercles of [illegible] arise slightly above the longitudinal pygidial axis but in [illegible] they arise obliquely from the



Text figure 1. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] posterior dorsal surface. In *brevicornis* the tubercles arise from an intermediate position well above the axis. The serpentine pattern of respiratory pores on each spiracular plate is raised in *ochracea* and *depleta,* and is divided into three groups which are only vaguely indicated in some specimens of *brevicornis.* These groups in *depleta* are separated by much deeper grooves than in *ochracea.* The stigmatic scar is fairly prominent and the anus is remote from the tubercles in all three species.

All puparia of *brevicornis* were formed in the laboratory essentially under normal seasonal temperatures. Two were obtained on 21 Aug., 1951, and ten more between 5 and 12 Aug., 1952. Each year the puparia were kept at about 23° C for a little over two months, held at 8° for two more months, then returned to 23°. Of the 1951 puparia, one female emerged on 10 March, 1952; the other, also a female, succumbed to mold shortly before emergence. Of the 1952 puparia, two males emerged after 11 days, and one male and one female emerged after 12 days, all before being placed in the cold room. The remaining six succumbed to mold and anthomyiid larvae in the insectary after cold treatment. Three of these contained fully formed flies, at least one of which was a female. Townsend (1936) cited a case of *E. ochracea* (Bigot) adults emerging in October, 12 days after the puparia were collected in Dallas, Texas. According to Wolcott (1951) the pupal stage of "*E. australis* (Tns.)" in Brazil lasts for ten days.

From these records it is evident that a diapause induced by winter cold is not necessary for adult development. On Cape Cod, adults of both *Neoconocephalus robustus* and *ensiger* have been taken at least until early October, while adults of several other likely orthopteran hosts, such as the katydid, *Amblycorypha oblongifolia carinata* R. & H., and the common cricket, *Acheta assimilis* F., live beyond mid-November in many seasons. In the vicinity of Dallas, the closely related *N. triops* (L.) has been collected in mid-December (Rehn and Hebard, 1944), and there are certainly many other possible hosts available beyond this date. With the probable capacity for a four to five week life cycle as far north as Cape Cod, this parasite could well produce at least two generations a year on adult Orthoptera alone. It can and probably does pass the winter in the puparium, although nothing is known of the mating habits and survival capabilities of the adult flies.

In an effort to fill in the range and determine the host preferenda of these little-known flies, 15 specimens of *N. r. robustus* in the Museum of Comparative Zoology, from Cape Cod to Long Island, were examined for the presence of larval breathing holes. Similarly examined were 176 specimens, representing nine other species of *Neoconocephalus* from Massachusetts to Minnesota, Texas, and Florida, together with 26 Florida specimens of the related genera *Belocephalus, Pyrgocorypha,* and *Homorocoryphus.* In addition, large numbers of Orthoptera have been collected in East Brewster for anatomical studies over the past five years, and lately re-examined. These have included such likely hosts as *N. ensiger* (Harris); the conocephaline, *Orchelimum vulgare* Harris; the phaneropterine, *Amblycorypha oblongifolia carinata* R. & H.; and the common cricket, *Acheta assimilis* F. All of these examinations proved negative except for a single male of *N. ensiger,* collected by Richard Dow in Needham, Mass., 7 Aug., 1936, which bore the characteristic larval breathing hole in the left pleural membrane of the sixth abdominal segment. After softening the specimen a half-grown larva, with the first instar exuviae adhering to the funnel, was dissected out. On comparison with equivalent material under study, there is little doubt that *E. brevicornis* also parasitizes *N. ensiger.*

C. W. Sabrosky has checked the ranges of the two subspecies of *E. brevicornis* against those of the two subspecies of this particular host, *N. r. robustus* and *r. crepitans,* and informs me that the ranges show no significant coincidence. Therefore, until further evidence is available, it is assumed that the two subspecies of *brevicornis* must utilize additional hosts, at least in other areas of the range, but one or more of the ten other species of *Neoconocephalus* are probably favored. The question as to whether or not only adult Orthoptera are parasitized remains unanswered. Should the adults of a certain species be the only host in a particular area, either the pupal stage or the adult life must be rather extended; on the other hand, if nymphal stages are also attacked, the host attrition must be considerable in favorable seasons.

Since all evidence has shown the genus to have a predilection for nocturnal orthopteran hosts, it is not surprising that, in the laboratory at least, the adult flies are also nocturnal. Wolcott (1951) has reported that "*E. australis*" adults hid in the darkest part of their cage during the day, but were unusually active at night. At present I can only confirm his observations and add that, during six years of occasional general collecting in the East Brewster area, I have never seen an adult fly. Many specimens seen by Mr. Sabrosky were collected at night, a further hint, but not proof, of nocturnal habits. Although much of the evidence cited above on range and host preference is either negative or purely circumstantial and speculative, it does explain the rarity and obscurity of these flies as well as their extremely local occurrence.

I extend my appreciation to C. W. Sabrosky of the Bureau of Entomology and Plant Quarantine for furnishing some of the pertinent references included, and especially for identification of the fly and description of the new subspecies, without which this information would be of little value. He made available for comparison the puparia of *E. ochracea* and *australis*, details of which are shown in text fig. 1. I also wish to thank Prof. H. J. Reinhard, of the Agricultural and Mechanical College of Texas, for his part in assisting in the identification.

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NEW DATA ON THE HABITS OF *CAMPONOTUS (MYRMAPHAENUS) ULCEROSUS* WHEELER

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In June 1951 the writer published, in this Journal, an account of the habits of *C.* (*M.*) *ulcerosus*. Since that time eight more colonies have been observed and additional data have been secured on the habits of this remarkable ant[1].

The truncated head of the major worker of *ulcerosus* has suggested to some myrmecologists a relationship with the subgenus *Colobopsis*. This view is unsatisfactory from a structural standpoint, for the two subgenera actually have little in common. Nor did it seem likely, since *ulcerosus* is a ground-dweller, that the head of the major could be used in phragmosis. It is now certain, however, that the major worker of *ulcerosus* does function as a door and does close the nest entrance with the front of the head in a fashion essentially similar to the phragmotic major of *Colobopsis*.

This is possible because *ulcerosus* constructs a carton shield at the nest entrance. In this shield is a single aperture which closely approximates, in size and shape, the truncated portion of the head of the major. The shield is made of a mixture of earth and bits of vegetable detritus. The shield is so fragile that it usually cannot be lifted away from the nest entrance intact and it is sometimes destroyed by a heavy rainstorm. The shield may be flat, dome-shaped or tubular. In the dome-shaped and tubular shields the length is from ten to fifteen millimeters and the diameter from seven to ten millimeters. Since the aperture is notably smaller, it forms a bottle-neck which the head of the major can close.

The major of *ulcerosus*, when acting as a door, lets the other members of the colony in and out by backing away from the aperture. In this respect it behaves essentially as does the major of *Colobopsis*. There are, however, a number of interesting differences in the process. When the head of the major of *Colobopsis* is serving in its phragmotic capacity, the only portions of it presented to the exterior are the jaws and the truncated anterior face. The antennae are folded back against the sides of the head and they are well removed from the exterior: it is difficult to see how they could receive tactile stimuli. This may be why Wheeler (Bull. Amer. Mus. Nat. Hist., Vol. 20, No. 10, p. 154, 1904) was unable to elicit any response when he attempted to cause the withdrawal of the *Colobopsis* major by touching the exposed portion of the head with a pin or straw. The head of the major of *ulcerosus*, when in the phragmotic position, can readily receive tactile stimuli with the antennae. For these parts are not concealed, but held so that each funiculus lies at one side of the aperture. The returning workers touch the exposed antennae of the occluding major with their own antennae to secure entry for, when thus stimulated, the major withdraws its head from the aperture. This same response can be elicited by touching the antennae of the occluding major with a bit of grass. The major of *ulcerosus* is capable of a rather surprising range of behavior when acting as a guard. As a general rule a strange ant can walk across the face of the *ulcerosus* major, when the latter has assumed the phragmotic position, without producing any visible response. Occasionally, however, the major will seize the strange ant in its jaws and jerk it into the nest, where it is, presumably, killed. Furthermore, the major of *ulcerosus* does not always take a position where its head blocks the entrance. During periods when little traffic is passing the "door", the major on guard often remains well inside the carton, with only the tips of the antennae showing at the aperture. From this position it can pop into place instantaneously, which it does if a strange ant walks onto the shield. If foraging has ceased and there are no strange ants in the vicinity, the major may retreat so far from the aperture that it cannot be seen when a beam of light is thrown through that opening. It is of interest to note that the major of *ulcerosus* is not limited to serving in a phragmotic capacity only. Some of the majors regularly leave the nest to forage with the medias and minors.

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[1] This work was done on a Guggenheim Fellowship for 1951-52.

A few other observations may be added. Workers returning to the nest always go in through the aperture headfirst. They will do so even when this involves considerable struggle with what they are carrying. In the event that some strange ant is on or near the shield, the returning *ulcerosus* workers make no effort to enter the nest. They will wander about nearby until the intruder leaves, at which time they will secure entry to the nest in the usual fashion. It is clear that *ulcerosus* is a very timid ant. It is much afraid of several smaller species, particularly *Xiphomyrmex spinosus insons*. If the two meet, the *Xiphomyrmex* will usually rob the *ulcerosus* worker of anything it is carrying. This may be the reason why the workers of *ulcerosus*, which are returning to the nest with food, will take a needlessly tortuous course over grass tufts. Such a course would minimize the chance for encounters with *Xiphomyrmex*, for the latter ant rarely leaves the surface of the soil when foraging.

Presented below are several records which add to the known range of *ulcerosus*:

ARIZONA: Huachuca Mountains, Carr Canyon, 5400′; Santa Rita Mountains, Sweetwater, 5800′; Chiricahua Mountains, Nat. Mon. Campground, 5400′.

CHIHUAHUA: Sierra de en Medio, Nogales Ranch, 5000’.

SONORA: Cerro San Jose (Naco) 5100’.

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